APPENDIX G

PHYSICAL RESOURCES

ACRONYMS, ABBREVIATIONS, AND SYMBOLS

cfs	cubic feet per second
CN	Curve Number
EISA	Energy Independence and Security Act
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FEIS	Final Environmental Impact Statement
ft^2	square feet
LHA	Landing Helicopter Amphibious
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
pH	Potential of Hydrogen
SCS	Soil Conservation Service
SEIS	Supplemental Environmental Impact Statement
T_c	Time of Concentration
TR	Technical Release
USDA	U.S. Department of Agriculture

PHYSICAL RESOURCES SUPPORTING INFORMATION

SOIL INFORMATION

Soil information in this Appendix is supplemental to the discussion of the Affected Environment Sections on Physical Resources of the alternative sites. Additionally, suggested best management practices for preventing and controlling soil erosion are discussed.

Common Soil Types Discussed in Document

Lakeland Sands

The Lakeland Sand series is the primary soil type for Eglin Air Force Base. These are primarily excessively drained, brownish-yellow sands that have developed along the tops of broad ridges and slopes. These soils are abundant on both level and steep uplands and can run up to 80 inches in depth. The Lakeland soils range in the potential of hydrogen (pH) scale from 4.5 to 6.0 and contain less than 1 percent organic matter in the top 40 inches of soil. Typically, depth to seasonal water table is more than 80 inches. All Lakeland Sands soil horizons or layers are fine sand with 5 to 10 percent silt plus clay in the 10- to 40-inch top sections. The unique combination of almost pure sand texture and very high soil infiltration, permeability, and hydrologic conductivity has created a distinctive landscape of excessively drained soils that have a high capacity to move water through the soil but limited capacity to hold water and nutrients in the soil (Overing and Watts, 1989).

Lakeland soils sustain the Sandhills ecological association (the largest ecological association on the base), and the Open Grassland/Shrubland, Sand Pine, Flatwoods, and Swamp associations. Lakeland soils are associated with Chipley, Dorovan, Foxworth, Lucy, and Troup soils. Only the Dorovan soils have a high degree of organic content; thus, they are considered mucks. Lakeland Sands vary in acidity from medium to very strong. Thus, soil colors vary a fair amount. They range in color from dark, grayish-brown to brownish-yellow to yellowish-brown (Overing and Watts, 1989).

Lakeland Sand soil series have a moderate susceptibility to erosion. This is due to the high sand content. However, in areas where the soils are mucky, erosion is less likely since mucks are comprised of organic matter and clay. Additionally, the less uniform the sediments are, the less chance for erosion. Variation of sediment size with the addition of clay and organic matter helps create soil stability. Slope also affects soil erodibility. Slopes are dominantly 0 to 12 percent (Overing and Watts, 1989).

The key chemical and physical properties of the Lakeland soils generally include:

- Less than or equal to 90 percent quartz sand.
- Less than 1 percent organic matter.
- Acidic pH (4.5 to 6.0).
- Extremely low Cation Exchange Capacity values (less than 4 milliequivalents per 100 grams).
- Rapid infiltration rate.
- Very high hydraulic conductivity of 20 to 28 inches per hour.

The resulting condition of a typical Lakeland soil is generally characterized as:

- Excessively drained.
- Poor soil structure (low cohesion, adhesion, and aggregate stability).
- Low fertility.
- Relatively low diversity, activity, and populations of soil organisms (bacteria, actinomycetes, fungi, algae, protozoa, arthropods, and earthworms).
- Absence of active soil-forming processes.

The unique combination of almost pure sand texture, very high soil infiltration and hydrologic conductivity, and high rainfall (approximately 62 inches per year) has created a distinctive landscape of potentially high soil constituent leachability and low biodegradation potential (Overing et al., 1995).

Chipley–Foxworth–Albany Soils

The Chipley series consists of very deep, moderately well-drained or somewhat poorly drained, rapidly permeable soils that formed in thick deposits of sandy marine sediments on uplands in the Lower Coastal Plain. The soil frequently occurs in association with the Hurricane soil series. Slopes range from 0 to 8 percent. Texture is sand or fine sand to depths of 80 inches or more. Silt plus clay content between depths of 10 and 40 inches is 5 to 10 percent. Reaction ranges from extremely acid to moderately acid in the A horizon except where limed and from very strongly acid to slightly acid in the C horizon (Overing et al., 1995).

Chipley soils are gently sloping, poorly drained soils that border drainages and flatwoods in upland areas. The upper 6 inches of Chipley soils are typically depicted as very dark gray sand. The underlying layers (up to approximately 80 inches) are dark, grayish-brown, overlaying yellowish-brown sand. Permeability is rapid with Chipley soils, making them well suited for crop cultivation. Corn, cotton, soybeans, and peanuts are often associated with this soil type (Overing et al., 1995).

Foxworth Series

The Foxworth series consists of very deep soils that formed in sandy marine or eolian sediments. These soils are on broad, nearly level, and gently sloping uplands and sloping to steep side slopes leading to drainage ways. Slopes range from 0 to 8 percent but most commonly are 0 to 5 percent. Runoff is very slow and permeability is rapid or very rapid. A water table fluctuates between depths of 48 to 72 inches below the soil surface for one to three months during most years and 30 to 48 inches for less than 30 cumulative days in some years. Thickness of sand exceeds 80 inches. Reaction ranges from very strongly acid to slightly acid throughout. Texture is sand or fine sand throughout and silt plus clay content in the control section is 5 to 10 percent (Overing et al., 1995).

Foxworth sands are moderately well-drained soils and, like Chipley soils, are located in flatwoods of upland areas. Permeability is rapid and these soils are dark gray. These soils, however, are not well suited for crop cultivation because they tend toward dryness. These are, however, conducive to upland growth such as longleaf pine and turkey oak (Overing et al., 1995).

Albany–Pactolus Loamy Sand

Albany–Pactolus Loamy Sand series range from somewhat poorly drained to moderately well-drained soils that are nearly level to gently sloping. The surface layer is typically loamy sand that ends at a depth of approximately 20 inches. The subsoil is a sandy loam and ranges in depth from 45 inches to 80 inches.

Albany soils are very loamy, somewhat poorly drained, and exist on seepage slopes in upland areas. These soils are a very dark grayish brown in the uppermost 6 inches, with layers of yellowish-brown, varying in lightness, for the following 80 inches of depth. Albany soils are well suited for crop cultivation such as peanuts and soybeans. Additionally, they are adaptable as pastureland (Overing et al., 1995).

Troup Sand

Troup Sand is a gently sloping soil that primarily occurs on ridgetops in upland areas. Due to the upland occurrence of this soil, slopes can range from 0 to 25 percent slope. Typically, the top 5 inches of Troup Sand is dark brown sand with lighter, yellowish-brown sand for the underlying 40 inches. The subsurface layer is a yellowish-brown to yellowish-red sand that reaches to a depth of 80 inches. Troup sands contain a seasonably high water table. Despite the seasonal high water table in specific areas, most Troup Sands are excessively drained. Due to the dryness of the soil, crop cultivation is generally not suited to Troup Sand; however, pastureland often can be created from Troup Sand (Overing et al., 1995).

Bonifay Loamy Sand

Bonifay Loamy Sand occurs in uplands as a strongly sloping, well-drained soil. The typical surface layer is very dark grayish-brown and is roughly 7 inches thick. Loamy subsoil occurs at a depth of 40 inches or more and tends to be yellowish in color. Surface runoff is rapid, but these soils generally hold a seasonal high water table from December to April. Bonifay soils are typically not well suited toward crop cultivation. Longleaf pine and turkey oak are naturally occurring types of vegetation on the soil (Overing et al., 1995).

Dorovan Series

The Dorovan series consists of very poorly drained, moderately permeable soils on densely forested floodplains, hardwood swamps, and depressions of the Coastal Plains. They formed in highly decomposed acid–organic materials. Slopes range from 0 to 2 percent, but are normally less than 1 percent. The organic material ranges from 51 inches thick to more than 80 inches thick. It is extremely acid or very strongly acid in the organic layers. It is strongly acid or very strongly acid in the 2C horizon. The soil remains saturated to the surface most of the time. Runoff is very slow and water is ponded on the surface in depressions. The underlying mineral sediments are commonly loamy or sandy and are very strongly acid or strongly acid (Overing et al., 1995).

Dorovan–Pamlico association soils are very poorly drained, nearly level, deep mucky soils, underlain with sandy material. Commonly referred to as Dorovan muck, this soil type and association occurs in hardwood swamps and floodplains. It is frequently flooded and forms a mucky, dark grayish peat for the first 4 inches. Below that, the muck becomes almost black, to a depth of 80 inches. Natural fertility is high since the organic content is high. Typical vegetation for this soil association is bald cypress, black gum, red maple, and water tupelo (Overing et al., 1995).

Rutledge Series

Rutledge fine sands are black to gray in color, with typical surface layers of black sand approximately 7 inches thick. Gray soils lie beneath this layer. Naturally occurring vegetation for Rutledge soils are bald cypress, black gum, red maple, and water tupelo. The Rutledge series consists of very deep, very poorly drained soils with rapid permeability. Rutledge soils are formed in sandy unconsolidated Coastal Plain sediments of marine origin. These soils occur on upland flats, floodplains, or depressions with planar or convex surfaces. They are also located in depressions such as bays, basins, or sinks. In depressional areas, the water table is near the surface for long periods of the year and ponding is common. Runoff is ponded or very slow and permeability is rapid throughout. Silt plus clay in the 10- to 40-inch control section averages 5 to 15 percent. The soil is extremely acid to strongly acid throughout, unless it has been limed. Slopes range from 0 to 2 percent (Overing et al., 1995).

Bonneau–Norfolk–Angie Complex Soils

Bonneau–Norfolk–Angie Complex soils occur as strongly sloping, upland soils that are moderately well drained. These soils range from loamy to sandy and contain loamy or clayey subsoil at a depth below 40 inches. The surface layer is generally 6 inches thick and yellowish-brown in color. A silty, clayey, brown loam follows the top layer to a depth of 80 inches. Natural vegetation for this soil association is loblolly pine, hickory, southern magnolia, and water oak. Cultivated crops as well as pastureland are suitable uses for this soil type (Overing et al., 1995).

Hurricane Series

The Hurricane series consists of very deep soils that formed in sandy marine sediments. These soils are on nearly level to gently sloping, low, broad landscapes that are slightly higher than the adjacent flatwoods of the Lower Coastal Plain. Slopes range from 0 to 5 percent. Hurricane soils are somewhat poorly drained. Runoff is slow and permeability is very rapid or rapid in the A and E horizons, and moderately rapid in the Bh horizon. The water table is at depths of 2 to 3.5 feet for three to six months during most years and at depths greater than 3.5 feet the remainder of the time. Some areas are subject to flooding for brief periods. The solum is 60 inches or more thick. Depth to the spodic horizon is 51 to 79 inches. Reaction ranges from moderately acid to extremely acid throughout (Overing et al., 1995).

Udorthents

Udorthents are materials in areas from which sand and loamy materials have been removed (e.g., through borrow pit excavation). The typical depth of these excavations in Okaloosa County ranges from 2 to 12 feet. The removed soil material was likely used in construction and road repair. Due to extensive mixing, identification of component soils is not possible. Udorthent soils are often barren and are not suitable for cultivation (Overing et al., 1995).

Urban Lands

Urban lands are generally located on nearly level to gently sloping hillsides and are located in areas covered with pavement or urban development. Urban land is predominant in and around the Okaloosa County Airport site. These soils are difficult to characterize because the natural soils cannot be observed. Typically these soils have been cut to a depth of 12 inches or more and have been covered with fill to an average depth of 12 inches. With the dominant coverage of Lakeland soils in surrounding areas, it is likely that the Urban soils in and around the Okaloosa County Airport site retains some Lakeland characteristics below the initial surface layer (Overing et al., 1995).

Best Management Practices for Preventing and Controlling Erosion

Soil Erosion Control

Soil erosion control is the prevention of soil particle displacement (erosion control); detention and/or diffusion of concentrated, uncontrolled water flow (runoff control); and control of the movement and deposition of displaced soil particles (sediment control).

Erosion Control

Erosion control is based on the application of relatively simple yet effective measures that prevent the displacement of soil particles by rainfall impact, water flow, or wind by increasing the resistance to detachment and/or reducing the transport capacity of stormwater runoff (Fifield, 1994). The principal means of achieving this objective is to create an environment that promotes the establishment of long-term, self-sustaining vegetative communities that are naturally engineered to anchor soil and diminish the erosive energy of flowing water. The significance of accelerated erosion and sedimentation increases exponentially with increasing land pressure. Uncleared lands act as sediment traps between land exposed to erosion and streams. As more land is exposed to erosion, the uncleared lands become less efficient as sediment traps and a greater proportion of the eroded material enters the streams.

Although erosion and sediment control are often used in the same context, the approach exercised by these methods is quite different. The primary difference is that erosion control practices offer an offensive strategy of attacking the sources of sediment, while sediment control is a stopgap defensive strategy of treating symptoms after the damage is done (Theisen and Agnew, 1993). It is important to employ erosion and sediment control practices jointly and not to rely on one method to the exclusion of the other.

The four principles of erosion control presented in the general order of design and implementation are as follows:

1. Manufacture stable slope grades. Soil erosion damage to slopes often creates an irregular, unstable profile that further accelerates water flows and inhibits vegetation occupancy. A slope, which is inherently unstable, will not support satisfactory vegetative cover until it has created a stable angle of repose, either by the process of erosion or mechanical reconstruction. A stable slope angle of repose minimizes erosion potentials and encourages the establishment of vegetation.

2. Recondition damaged soils. Soil is a living media that is host to a diversity of structural, chemical, and biological (soil flora and fauna) interdependent constituents. Changes in the structure, chemical composition, or populations of microbial life will diminish the capacity of soil to support vegetation. In a damaged, dysfunctional state, soils are easily eroded, overall ecosystem functions are adversely impacted, and water quality decreases. Reestablishing vegetation is dependent on restoring the health and functions of soil environments.

   Many environmental management restoration soils are structurally damaged or are depleted of vital soil components necessary for supporting vegetative growth. Soil reconditioning promotes soil structural stability; stimulates increases in the diversity, populations, and activity of soil organisms; restores soil humus components; and promotes nutrient recycling and soil water retention.

3. Establish permanent vegetative cover. Vegetative covers provide the best-known soil protection. Stable vegetative cover minimizes the effects of raindrop impacts, reduces the velocity of runoff, holds soils in place, tends to be self-healing, is generally less expensive compared to structural features, and is often the only practical long-term solution for stabilization and erosion control on most disturbed sites. Revegetation requires thorough planning and maintenance. Site investigations and planning for vegetation stabilization reduce its cost, minimize maintenance and repair, and make other erosion and sediment control measures more effective and less costly to maintain. Grasses are particularly well adapted to erosion control. Plants also remove water from the soil through transpiration, thus increasing the soil's water-absorbing capacity.

4. Stabilize slope soils. Even under stable grades, bare soil is still susceptible to erosion. In lieu of vegetative cover establishment or in combination with planting, measures are taken to minimize the detachment and transport of soil particles resulting from raindrop impact and surface flows. Mulching practices are employed to provide a protective cover that complements soil stability, soil quality improvement, and the establishment of vegetation.

Runoff Control

The natural tendency of water is to channelize, suspend soil particles and other materials to the degree possible, and race downhill toward stream outlets. As water gains speed, the suspended soil materials act as sandpaper grinding away at the channel bottom and banks. Offered the opportunity to continue to concentrate, flowing water columns follow the line of least resistance, producing incisions in the landscape known as rills and gullies. The success of most erosion control practices is dependent on the installation of runoff control practices that apply theoretical brakes to concentrated, uncontrolled water flow. The results of reductions in the velocity of water flow can be quite dramatic. If downhill water flow is reduced by half, the erosion-causing capacity is reduced by a factor of 4, the amount of sediment carried downhill is reduced approximately 34 times, and the size of particles that can be pushed or rolled is reduced 64 times (Roley, 1994). It becomes quite evident that slowing down the flow of water effectively reduces its erosive potential. The three principles of runoff control are as follows:

1. Transport runoff within non-erosive water conveyance systems. Drains frequently transport water at volumes and velocities beyond what would be encountered for that site under natural undisturbed conditions. It is therefore critical that the channels are designed and constructed to manage water flows in a manner that does not cause the deterioration and erosion of the channel, and that vegetative and structural measures be installed to control erosive channel flows.
2. Intercept and diffuse the erosive energy of runoff at predetermined intervals. Vegetative and structural measures are installed at design intervals along water flow paths to intercept and disrupt flow without recreating a concentrated water flow problem in another location. A chronic problem experienced by some engineered structures, such as in-channel check dams, is the interception and concentration of water flow energy in areas sensitive to erosion. Vegetative and/or engineered structural measures are used to intercept and diffuse the erosive energy of moving water. An underlying principle is that smaller water volumes are easier to control and have a lower sediment transport capability compared to larger water volumes.
3. Transition water flows to non-erosive discharge points. The interception of water creates a discharge behavior that may be as erosive as the initial energy intercepted. Structural measures are used at outlet points to release water under non-erosive conditions.

Sediment Control

Sediment control must be implemented at the proper time and location in order to be effective. For example, collecting lost soil resources with hay bales or sediment traps at the stream discharge point provides no long-term benefit to reducing the damage and loss of soil resources at the uphill points of origin. Although providing water quality protection, these types of sediment controls are quickly overwhelmed by sediment loading if erosion and runoff control practices are not jointly installed.

WATER RESOURCES

Stormwater

Stormwater-carried sediment can alter water quality, aquatic habitats, hydrologic characteristics of streams and wetlands, and increase flooding. Land-disturbing activities (such as clearing) and the addition of impermeable surfaces (concrete, asphalt, etc.) would result in increases in stormwater runoff. The effects, however, vary based on the amount of new impervious surface areas, topography, rainfall, soil characteristics, and other site conditions. The rate and volume of stormwater runoff has the potential to impact the quality and utility of water resources (FDEP, 2002).

Laws and Regulations—Stormwater

Stormwater management is addressed in Chapter 62-346, Florida Administrative Code (FAC), for any activity that has the potential to impact stormwater quality or disturb more than 1 acre of land. These activities must be permitted in accordance with National Pollutant Discharge Elimination System (NPDES) regulations as administered by the FDEP. Chapter 62-346, FAC, also stipulates which permits are required for the construction, alteration, or maintenance of stormwater management systems in northwest Florida. Any changes to or creation of stormwater management systems by the project would require an individual permit for each action. The Air Force must obtain from the FDEP a Generic Permit for Stormwater Discharge for Large and Small Construction Activities. An Application for Stormwater Permit in Northwest Florida will be submitted by the Air Force prior to project initiation according to FAC Rule 62-346. Additionally, guidance under Section 438 of the Energy Independence and Security Act (EISA), passed in 2007, for federal facility projects over 5,000 square feet (ft^2) will be followed. Section 438 of the EISA requires federal development and redevelopment to "maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow.

Analysis Methodology—Water Resources

Impacts to stormwater from the proposed action focused on changes to stormwater runoff amounts and possible increases in runoff volume and velocity due to land clearing and increases in impervious surfaces from construction activities over current conditions. To determine stormwater runoff volume and velocity changes, the Natural Resources Conservation Service (NRCS) WinTR-55 computer model was utilized. A detailed description of the model and its parameters and limitations can be found in Appendix G – Physical Resources of the Proposed Implementation of the 2005 Eglin Base Realignment and Closure Decisions and Related Actions at Eglin Air Force Base Final Environmental Impact Statement (the FEIS). For the purposes of the Supplemental Environmental Impact Statement (SEIS) a more updated version of the WinTR-55 Model (Version 1.00.09) and User

Guide (dated January 2009) were downloaded from the NRCS website found at http://www.wsi.nrcs.usda.gov/products/W2Q/H&H/Tools_Models/WinTR55.html. The same rainfall distribution (Type III) and storm frequency (25-year storm event) information used to run the model for the FEIS was also used in the SEIS. As stated in the FEIS, a 25-year, 24-hour storm event is one that theoretically occurs once every 25 years and lasts for 24 hours. This type of rain event yields 10.23 inches of rain in Okaloosa County, Florida. Furthermore, all proposed construction sites for each alternative are predominately composed of Lakeland Sand, so Hydrologic Soil Groups A was used for the evaluations.

Results

Once the rainfall, soil condition, land use areas, flow types, flow lengths, and slope of the land are entered, WinTR-55 calculates the curve number (CN) and time of concentration (T_c) values. From there the model is run to yield the peak discharge flow of stormwater runoff in cubic feet per second (cfs). Additionally, a Technical Release 20 (TR-20) report can be run to determine the total amount of runoff for the area in inches. Following is the methodology followed and data entered for each of the alternatives analyzed in the SEIS.

Peak Runoff Discharge Rate and Volume: Alternative 1I

The Alternative 1I single runway site was divided into two sub-areas that correspond to the surface water bodies located within that area, namely Toms Creek to the north and Garnier Creek to the south. The WinTR-55 model requires certain minimal inputs in order to run properly. For this alternative, Toms Creek and Garnier Creek were treated as two separate outlets where runoff would potentially leave the site. The model was run twice to depict pre-construction conditions and post-construction conditions. The paved area in the post-construction scenario was calculated based on the assumption that the new runway would be approximately 2,000,000 ft^2, which is approximately 46 acres. The parameters for each situation are included in Table G-1 and Table G-2.

Table G-1. Alternative 1I Single Runway Pre-Construction Parameters Used for WinTR-55 Modeling

WinTR-55 Parameters	Sub-Area I		Sub-Area II	
Receiving Reach/Outlet	Outlet TC		Outlet GC	
Soil Condition	A		A	
Land Use	Woods/grass combination		Woods/grass combination	
Area (acres)	675		1,453	
Weighted CN	32		37	
Flow Type	Shallow concentrated (unpaved)	Channel	Shallow concentrated (unpaved)	Channel
Flow Length (feet)	1,842	5,004	7,892	6,600
Slope	0.005	0.15	0.003	0.15
T_c (hour)	0.448		1.913	

Table G-2. Alternative 1I Single Runway Post-Construction Parameters Used for WinTR-55 Modeling

WinTR-55 Parameters	Sub-Area I		Sub-Area II		
Receiving Reach/Outlet	Outlet TC		Outlet GC		
Soil Condition	A		A		
Land Use	Newly developed area (pervious only)		Newly developed area (pervious only)	Paved; open ditches	
Area (acres)	675		1,407	46	
Weighted CN	77		77		
Flow Type	Shallow concentrated (unpaved)	Channel	Shallow concentrated (unpaved)	Shallow concentrated (paved)	Channel
Flow Length (feet)	1,842	5,004	4,862	2,970	6,600
Slope	0.005	0.15	0.003	0.003	0.15
T_c (hour)	0.448		2.269		

The reach data used to run the model were the same for both the pre-construction condition and the post-construction condition. Table G-3 shows the reach and outlet information used to run the WinTR-55 model under both circumstances.

Table G-3. Reach Data for the Alternative 1I Single Runway Construction Site Used for Pre- and Post-Construction WinTR-55 Modeling

WinTR-55 Parameters	Toms Creek	Garnier Creek
Receiving Reach	Outlet	Outlet
Reach Length (ft)	5,004	6,600
Manning n	0.07	0.07
Friction Slope (ft/ft)	0.15	0.15
Bottom Width (ft)	150	150
Average Side Slopes	7 : 1	7 : 1

Under the pre-construction scenario, the model yielded a peak flow of 411 cfs for Toms Creek and 714 cfs for Garnier Creek. Total runoff amounts for Toms Creek and Garnier Creek under the pre-construction scenario were 1.321 inches and 1.962 inches, respectively. Post-construction model results were higher due to the increase of impervious area (46 acres) and change of land use associated with clearing activities required at the Alternative 1I single runway construction site. Under the post-construction scenario, the model yielded a peak flow of 3,448 cfs for Toms Creek and 2,977 cfs for Garnier Creek. Total runoff amounts for both Toms Creek and Garnier Creek under the post-construction scenario increased to 7.371 inches.

Peak Runoff Discharge Rate and Volume: Alternative 2—Duke Field Main Operating Base

There are no surface water bodies on Duke Field where construction activities would occur; therefore, no reach data were needed to run the model. Furthermore, the elevation of the area did not vary significantly and as such the proposed site was not subdivided into multiple sub-areas. It was assumed all stormwater would flow to a specific outlet point based on the elevation changes of the surrounding area. This assumption makes the calculations of the model conservative in that stormwater will likely spread throughout the parcel and not be directed to only one specific outlet point. The model was run twice to depict pre-construction conditions and post-construction conditions. The paved area in the post-construction scenario was calculated based on the proposed construction activities and associated square footages as listed in Table 2-17 in Section 2.3.5.1 of the SEIS. The parameters for each situation are included in Table G-4 and Table G-5.

Under the pre-construction scenario, the model yielded a peak flow of 316 cfs. Total runoff amount for the area under the pre-construction scenario was 1.45 inches. Under the post-construction scenario, the model yielded a peak flow of 2,508 cfs, while the total runoff amount increased to 7.50 inches. Post-construction model results were higher due to the increase of impervious area and change of land use associated with clearing and construction activities proposed to occur in the undeveloped portions of Duke Field.

Table G-4. Alternative 2 Duke Field Main Operating Base Pre-Construction Parameters Used for WinTR-55 Modeling

WinTR-55 Parameters	Area I	
Receiving Reach/Outlet	Outlet	
Soil Condition	A	
Land Use	Woods/grass combination	Paved road; open ditches
Area (acres)	660.5	11.5
Weighted CN	33	
Flow Type	Shallow concentrated (unpaved)	Shallow concentrated (paved)
Flow Length (feet)	3,129	2,933
Slope	0.008	0.009
T_c **(hour)**	1.024	

Table G-5. Alternative 2 Duke Field Main Operating Base Post-Construction Parameters Used for WinTR-55 Modeling

<table>
<tr><th>WinTR-55 Parameters</th><th colspan="6">Area I</th></tr>
<tr><td>Receiving Reach/Outlet</td><td colspan="6">Outlet</td></tr>
<tr><td>Soil Condition</td><td colspan="6">A</td></tr>
<tr><td>Land Use</td><td colspan="2">Newly graded area (pervious only)</td><td colspan="2">Urban districts; industrial</td><td colspan="2">Paved road; curb & storm sewers</td></tr>
<tr><td>Area (acres)</td><td colspan="2">553.8</td><td colspan="2">95.1</td><td colspan="2">23.1</td></tr>
<tr><td>Weighted CN</td><td colspan="6">78</td></tr>
<tr><td>Flow Type</td><td colspan="3">Shallow concentrated (unpaved)</td><td colspan="3">Shallow concentrated (paved)</td></tr>
<tr><td>Flow Length (feet)</td><td colspan="3">3,129</td><td colspan="3">2,933</td></tr>
<tr><td>Slope</td><td colspan="3">0.008</td><td colspan="3">0.009</td></tr>
<tr><td>T_c (hour)</td><td colspan="6">0.9</td></tr>
</table>

Peak Runoff Discharge Rate and Volume: Alternatives 2A, 2B, 2C—Duke Field Parallel Runways and Landing Helicopter Amphibious (LHA)

Honey Creek and multiple branches of Silver Creek are located within the Alternative 2 parallel runway construction site. To run the WinTR-55 model, this site was divided into 10 sub-areas based on the locations of these creeks and the various changes in elevation throughout the site that would impact the flow of stormwater at the site. Similar to Alternative 1I, the model was run twice to depict pre-construction and post-construction scenarios. The paved area in the post-construction scenario took into account the areas for the new runway, LHA, and taxiways as listed in Table 2-17 in Section 2.3.5.1 of the SEIS. The parameters used to run the model for the pre-construction and post-construction scenarios are provided in Table G-6 and Table G-7, respectively.

Table G-6. Alternative 2 Parallel Runway Pre-Construction Parameters Used for WinTR-55 Modeling

Sub-Areas	Receiving reach/outlet	Soil Condition	Land Use	Area (acres)	Weighted CN	Flow type	Flow length (ft)	Slope	T_c (hr)
I	Outlet SC	A	Woods/grass combination	69.7	32	Shallow concentrated (unpaved)	422	0.06	0.10
						Channel	2,835	0.15	
II	SC2	A	Woods/grass combination	65.6	32	Shallow concentrated (unpaved)	2,323	0.04	0.20
						Channel	795	0.15	
III	SC3	A	Woods/grass combination	371.1	32	Shallow concentrated (unpaved)	2,218	0.05	0.17
						Channel	3,490	0.15	
IV	SC4	A	Woods/grass combination	128.1	32	Shallow concentrated (unpaved)	612	0.04	0.10
						Channel	2,222	0.15	
V	SC5	A	Woods/grass combination	243.4	32	Shallow concentrated (unpaved)	3,168	0.03	0.32
						Channel	4,125	0.15	
VI	SC2	A	Open space	85.9	40	Shallow concentrated (unpaved)	3,265	0.007	0.67
			Streets and roads: Gravel	3.4					
VII	SC3	A	Open space	97.2	40	Shallow concentrated (unpaved)	3,168	0.008	0.61
			Streets & roads: Gravel	3.6					
VIII	SC4	A	Open space	165.6	33	Shallow concentrated (unpaved)	5,132	0.01	0.90
			Streets and roads: Gravel	5.2					
			Woods/grass combination	775.6					
IX	Outlet HC	A	Woods/grass combination	200.5	32	Shallow concentrated (unpaved)	422	0.12	0.10
						Channel	1,910	0.15	
X	HC	A	Open space	138.5	33	Shallow concentrated (unpaved)	7,603	0.003	2.39
			Streets and roads: Gravel	2.6					
			Woods/grass combination	721.6					

Table G-7. Alternative 2 Parallel Runway Post-Construction Parameters Used for WinTR-55 Modeling

Sub-Areas	Receiving reach/outlet	Soil Condition	Land Use	Area (acres)	Weighted CN	Flow Type	Flow length (ft)	Slope	T_c (hr)
I	Outlet SC	A	Newly graded area (pervious)	69.7	77	Shallow concentrated (unpaved)	422	0.06	0.10
						Channel	2,835	0.15	
II	SC2	A	Newly graded area (pervious)	65.6	77	Shallow concentrated (unpaved)	2,323	0.04	0.20
						Channel	795	0.15	
III	SC3	A	Newly graded area (pervious)	371.1	77	Shallow concentrated (unpaved)	2,218	0.05	0.17
						Channel	3,490	0.15	
IV	SC4	A	Newly graded area (pervious)	128.1	77	Shallow concentrated (unpaved)	612	0.04	0.1
						Channel	2,222	0.15	
V	SC5	A	Newly graded area (pervious)	243.4	77	Shallow concentrated (unpaved)	3,168	0.03	0.32
						Channel	4,125	0.15	
VI	SC2	A	Newly graded area (pervious)	85.9	77	Shallow concentrated (unpaved)	2,528	0.007	0.64
			Paved; open ditches	3.4		Shallow concentrated (paved)	737		
VII	SC3	A	Newly graded area (pervious)	77.8	78	Shallow concentrated (paved)	3,168	0.008	0.48
			Paved; open ditches	23					
VIII	SC4	A	Newly graded area (pervious)	892.4	77	Shallow concentrated (unpaved)	802	0.01	0.74
			Paved; open ditches	54		Shallow concentrated (paved)	4,330		
IX	Outlet HC	A	Newly graded area (pervious)	197.5	77	Shallow concentrated (paved)	422	0.12	0.1
			Paved; open ditches	3		Channel	1,910	0.15	
X	HC	A	Newly graded area (pervious)	850.7	77	Shallow concentrated (unpaved)	4,435	0.003	2.184
			Paved; open ditches	12		Shallow concentrated (paved)	3,168		

The reach data used to run the model were the same for both the pre-construction condition and the post-construction condition. Table G-8 shows the reach and outlet information used to run the WinTR-55 model under both circumstances for Alternative 2.

Table G-8. Reach Data for the Alternative 2 Parallel Runway Construction Site Used for Pre- and Post-Construction WinTR-55 Modeling

WinTR-55 Parameters	Outlet SC	SC2	SC3	SC4	SC5	Outlet HC
Receiving Reach	Outlet SC	Outlet SC	Outlet SC	SC3	SC3	Outlet HC
Reach Length (feet)	2,835	795	3,490	2,222	4,215	1,910
Manning n	0.05	0.05	0.05	0.05	0.05	0.05
Friction Slope (ft/ft)	0.15	0.15	0.15	0.15	0.15	0.15
Bottom Width (feet)	50	50	50	50	50	50
Average Side Slopes	7 : 1	7 : 1	7 : 1	7 : 1	7 : 1	7 : 1

Under the pre-construction scenario, the model yielded a peak flow of 854 cfs for Silver Creek and 244 cfs for Honey Creek. Total runoff amounts for Silver Creek and Honey Creek under the pre-construction scenario were 1.478 inches and 1.422 inches, respectively. Post-construction model results were higher due to the increase of impervious area and change of land use associated with clearing activities required at the Alternative 2 parallel runway construction site. Under the post-construction scenario, the model yielded a peak flow of 7,258 cfs for Silver Creek and 1,629 cfs for Honey Creek. Total runoff amounts for Silver Creek and Honey Creek under the post-construction scenario increased to 7.378 inches and 7.371 inches, respectively.

Peak Runoff Discharge Rate and Volume: Alternatives 2D and 2E—Duke Field LHA

Since there are no surface water bodies on Duke Field where LHA construction activities would occur and the elevation of the site does not vary significantly, the proposed site was not divided into multiple sub-areas. This area has already been cleared and is part of a currently disturbed portion of Duke Field. It was assumed all stormwater would flow to a specific outlet point based on the elevation changes surrounding the construction site. This assumption makes the calculations of the model conservative in that stormwater will likely spread throughout the area instead of flowing to only one specific outlet point. The model was run twice to depict pre-construction conditions and post-construction conditions. The paved area in the post-construction scenario was calculated based on the proposed dimensions of the LHA. The parameters used to run the model for the pre-construction and post-construction scenarios are provided in Table G-9 and Table G-10, respectively.

Table G-9. Alternative 2 Duke Field LHA Pre-Construction Parameters Used for WinTR-55 Modeling

WinTR-55 Parameters	Area I
Receiving Reach/Outlet	Outlet
Soil Condition	A
Land Use	Newly graded area (pervious only)
Area (acres)	44
Weighted CN	77
Flow Type	Shallow concentrated (unpaved)
Flow Length (feet)	1,607
Slope	0.001
T_c **(hour)**	0.875

Table G-10. Alternative 2 Duke Field LHA Post-Construction Parameters Used for WinTR-55 Modeling

<table>
<tr><th>WinTR-55 Parameters</th><th colspan="2">Area I</th></tr>
<tr><td>Receiving Reach/Outlet</td><td colspan="2">Outlet</td></tr>
<tr><td>Soil Condition</td><td colspan="2">A</td></tr>
<tr><td>Land Use</td><td>Newly graded area (pervious only)</td><td>Paved roads; open ditches</td></tr>
<tr><td>Area (acres)</td><td>38</td><td>6</td></tr>
<tr><td>Weighted CN</td><td colspan="2">78</td></tr>
<tr><td>Flow Type</td><td colspan="2">Shallow concentrated (paved)</td></tr>
<tr><td>Flow Length (feet)</td><td colspan="2">1,607</td></tr>
<tr><td>Slope</td><td colspan="2">0.001</td></tr>
<tr><td>T_c (hour)</td><td colspan="2">0.694</td></tr>
</table>

Under the pre-construction scenario, the model yielded a peak flow of 164 cfs. Total runoff amount for the area under the pre-construction scenario was 7.37 inches. Under the post-construction scenario, the model yielded a peak flow of 188 cfs, while the total runoff amount increased to 7.50 inches. Post-construction model results were only slightly higher due to the increase of impervious area from the new LHA.

REFERENCES

Fifield, J. S., 1994. What is required for effective sediment control? *Land and Water*, Vol 38, pp 39–40.

Florida Department of Environmental Protection (FDEP), 2002. Florida Stormwater, Erosion, and Sedimentation Control Inspector's Manual. Technical Report.

Natural Resources Conservation Service (NRCS), 2005. NRCS WinTR-55 Computer Model Program, Version 1.0.08. Created 2 December 2004. Downloaded from http://www.wcc.nrcs.usda.gov/hydro/hydro-tools-models-wintr55.html, on 8 January 2007.

Overing, J. D., and F. C. Watts, 1989. Soil Survey of Walton County, Florida. USDA Soil Conservation Service, Washington, D.C.

Overing, J. D., H. H. Weeks, J. P. Wilson, Jr., J. Sullivan, and R. D. Ford, 1995. Soil survey of Okaloosa County, Florida. USDA Soil Conservation Service, Washington, D.C.

Roley, W., 1994. Watershed Management and Sediment Control for Ecological Restoration. *Land and Water*, Vol 38, pp 16–17.

Theisen, M. S., and W. Agnew, 1993. The Expanding Role of Geosynthetics in Erosion and Sediment Control. Land and Water. January/February 1993.

U.S. Department of Agriculture (USDA), 1975. Urban Hydrology for Small Watersheds, *SCS Technical Release 55* (TR-55). First issued in January 1975.